

REMARKS

Interview Summary

Applicant thanks the Examiner for the time and courtesy extended in conducting a telephonic interview with Applicant's representatives on April 30, 2010. During the interview, the rejection of claims 2-19 under 35 U.S.C. § 103(a) and possible claim amendments were discussed. No formal agreement was reached, but the Examiner pointed out potentially patentable subject matter, as discussed below. The substance of the interview is made of record in this paper.

Status of Claims

Applicant has amended claims 2 and 3 to incorporate subject matter of claims 10 and 19, respectively, to more particularly and distinctly point out the claimed subject matter, and to adopt the Examiner's suggestions during the interview. Applicant has cancelled claims 10 and 19. The claim amendments are supported by the original claims and the as-filed specification, e.g., paragraph [0053]-[0054] (paragraphs [0058]-[0059] of the Patent Application Publication No. 2007/0165687); Fig. 1. No new matter has been introduced.

Rejection under 35 U.S.C. § 103(a)

Applicant respectfully traverses the 35 U.S.C. § 103(a) rejection of claims 2-19 over U.S. Patent Application Publication No. 2002/0118710 to Kopp et al. ("Kopp '710") for at least the following reasons, as also discussed during the interview. The cancellation of claims 10 and 19 obviates the rejection of these claims.

A. Kopp '710 neither discloses nor suggests the claimed directors parallel to each other.

Each of amended claims 2 and 3 recites, among other things, “[a] first cholesteric liquid crystal layer and [a] second cholesteric liquid crystal layer are aligned such that the directors of the cholesteric liquid crystals in the surface on [a] defect layer side of said first cholesteric liquid crystal layer, and the directors of the cholesteric liquid crystals in the surface on the defect layer side of said second cholesteric liquid crystal layer, are parallel to each other.”

Kopp ‘710 neither discloses nor suggests the above-quoted features of amended claims 2 and 3. The Office Action relied on paragraph [0039] of Kopp ‘710 and asserted that Kopp ‘710 allegedly teaches the above-mentioned features. Applicant respectfully disagrees for at least the following reasons.

The cited paragraph [0039] merely provides definitions of common terms in the art. Specifically, paragraph [0039] discloses the following:

the average direction of the molecules, known as a "director", rotates helically throughout the cholesteric material. A pitch of a cholesteric material is defined as a thickness of the material in which the director rotates a full 360 degrees.

Here, the terms “director” and “pitch” are defined in one cholesteric material. This portion does not disclose or suggest a positional relationship of directors of cholesteric liquid crystals (CLC) included in two different liquid crystal layers. Directors on two parallel separate layers can form skew lines that do not intersect but are not parallel. The above teaching of Kopp ‘710 therefore does not necessarily disclose or suggest that the directors in the surface portions of the opposite CLC layers are parallel to each other. Accordingly, Kopp ‘710 neither discloses nor suggests at least the above-quoted features of amended claims 2 and 3.

B. Kopp '710 neither discloses nor suggests the claimed defect layer composed of an anisotropic medium

Amended claim 2 also recites, among other things, “[a] defect layer containing a dye . . . disposed between [a] first cholesteric liquid crystal layer and [a] second cholesteric liquid crystal layer. . . composed of an anisotropic medium.” Amended claim 3 recites substantially the same feature as the above-quoted features of amended claim 2.

Kopp '710 neither discloses nor suggests the above features of amended claims 2 and 3. The Office Action relied on Kopp '710 at paragraph [0044] and contends that Kopp '710 purportedly discloses “the use of anisotropic medium in the CLC (section [0044]) and discloses the defect may be physical spacing or dielectric material which crystal or liquid crystal can be a dielectric material; and by definition ‘crystals are often naturally anisotropic, and in some media (such as liquid crystals)’ (http://en.wikipedia.org/wiki/Crystal_optics#Anisotropic_media).” Office Action, pages 3-4 and 7.

Kopp '710 at paragraph [0044] (relied on by the Office Action), however, discloses a theoretical study applied to anisotropic stratified media and later applied to CLCs. The disclosed use of anisotropic material in the theoretical study does not teach or suggest that a defect layer containing a dye disposed between a first cholesteric liquid crystal layer and a second cholesteric liquid crystal layer is “composed of an anisotropic medium,” as recited in claims 2 and 3.

Furthermore, Applicant respectfully disagrees with the above-mentioned Office’s position that a defect may be dielectric material and liquid crystal can be dielectric

material,” and “crystals are often naturally anisotropic, and in some media (such as liquid crystals),” relying on the information cited from Wikipedia. Kopp ‘710 discloses a defect 122 that may be a dielectric structure. The cited Wikipedia information further discloses that “crystals are often naturally anisotropic, and in some media (such as liquid crystals) it is possible to induce anisotropy by applying an external electric field.” It indicates that crystals in liquid crystals are induced to exhibit anisotropy by applying an external electric field. But it does not necessarily teach or suggest that the structure of liquid crystals themselves show anisotropy before applying such an external electric field. Therefore, the above teachings of Kopp in view of the cited Wikipedia information neither disclose nor suggest a defect layer composed of an anisotropic medium.

Also, the as-filed specification discloses e.g., at paragraphs [0007-0009] that a laser oscillation element uses a defect layer composed of an anisotropic medium in order to decrease a minimum value (threshold value) of incident energy required for laser oscillation. Further, the present application discloses that the claimed laser oscillation elements achieve unexpected beneficial results that were not predicted in Kopp ‘710. Specifically, the specification at paragraphs [0077]-[0084] discloses Examples 1-4 of the claimed invention. Fig. 4 shows improvement of reflectivity in Example 2 (3) compared to examples wherein a defect layer is either absent (1) or composed of isotropic medium (2). Furthermore, Figs. 5 and 6 show that in Example 4 of the claimed invention, a substantially linear relationship between incident energy and emission light is established such that a sufficient intensity of laser light can be achieved even in a low-energy range (e.g., when the incident energy is less than 0.1 W/cm) and

accordingly continuous wave lasing also can be achieved. See also paragraphs [0106]-[0107].

These unexpected beneficial results were not disclosed or predicted in Kopp '710. Kopp '710 neither discloses nor suggests any teaching regarding directors in the surface portions of the CLC layers on the defect side, or the above-discussed beneficial results from the parallel directors on the surface portions of the opposite CLC layers. Kopp '710 instead teaches at paragraph [0055] that "to achieve maximum lasing efficiency and power, the light-emitting material should be placed in a position between the CLC layers and the size of the light-emitting material should be approximately one quarter of a wavelength of light inside the layered structure formed by the CLC layers and the light -emitting material." Kopp '710 also teaches at paragraph [0061] introduction of a light-emitting material comprising dye-doped material. Kopp '710 further teaches introduction of a defect in the light-emitting material, as shown in Fig. 1F. Accordingly, one of ordinary skill in the art, in view of the teachings from Kopp '710, would not recognize that selection of an anisotropic medium for a defect layer in Kopp '710 would result in a decrease in a minimum value of incident energy for highly efficient laser oscillation. See M.P.E.P. § 2144.07. Therefore, one of ordinary skill in the art would not have had any legitimate reason to modify Kopp '710 to arrange by design the directors in the surface portions of the opposite CLC layers on the defect side as parallel to each other. Nor would one skilled in the art have expected such beneficial outcomes therefrom.

Accordingly, Kopp '710 does not disclose one of a finite number of predictable solutions, with a reasonable expectation of success. Kopp '710 also does not present a

case of a predictable use of prior art elements according to their intended use, nor does Kopp '710 present a simple substitution of one known element for another.

For at least the above reasons, amended claims 2 and 3 are allowable over Kopp '710.

Claims 4-9, 13, 14, 16-18 depend from amended claim 2, and incorporate all of the elements of amended claim 2. Claims 4-9, 13, 14, and 16-18 are allowable for at least the same reasons as amended claim 2.

Claims 11, 12, and 15 depend from claim 3, and incorporate all of the elements of amended claim 3. Claims 11, 12, and 15 are allowable for at least the same reasons as amended claim 3.

C. Recitation of the claimed alignment substrate comprising an alignment film

Notwithstanding the above arguments, in view of the results of the interview, wherein the Examiner stated that, in his view, the disclosure at paragraph [0059] of the Patent Application Publication No. 2007/0165687 (paragraph [0054] of the as-filed specification), in combination with the above-discussed claim features, would recite patentable subject matter, Applicant has further amended the claims 2 and 3 to recite “a first alignment substrate provided on [a] first cholesteric liquid crystal layer on the opposite side to [a] defect layer; and a second alignment substrate provided on [a] second cholesteric liquid crystal layer provided on the opposite side to the defect layer, wherein the first and second alignment substrates each comprises an alignment film_ composed of a material selected from a polyamide, a polyvinyl alcohol or a silane coupling agent.”

As discussed during the interview, none of the references of record including Kopp '710 discloses or suggests the above-quoted features of amended claims 2 and 3. For instance, Kopp '710 instead discloses that on each of cholesteric liquid crystal layers on the opposite side to a defect layer, first and second electrodes are provided. See Figs. 1A, 1D, and 1G. Kopp '710 does not disclose or suggest an alignment substrate comprising an alignment film.

For this additional reason, claims 2 and 3, as amended, and their respective dependent claims, are allowable.

Conclusion

In view of the foregoing amendments and remarks, Applicant respectfully requests reconsideration of this application and timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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